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1951

THE PAN-PACIFIC ENTOMOLOGIST

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The Pan-Pacific Entomologist

Vol. XXVII January, 1951 No. 1

NEW HETEROMORPHOSES IN DROSOPHILA MELANOGASTER MEIG.

Richard B. Goldschmidt
University of California, Berkeley

Introduction

The classic example of heteromorphosis is the regeneration of antennulae after removal of an eyestalk in a number of Crustacea (Herbst 1895 seq.). Heteromorphosis thus is defined as replacement of an organ by another one of different morphology. In a general way such structures, whether they are produced by experimentation or occur spontaneously, whether they are hereditary (if known) or not, may be subdivided into the following major groups:

1. Morphoses which are more or less teratological variants of the organ in question, the latter still being recognizable in its general structure. Many mutants of Drosophila belong to this group e.g., aristaless (antennae), dachs (legs), and numerous teratological cases in many insects. [See for the latter the monograph by Cappe de Baillon (1927) and Bateson's classic work (1894); for Drosophila mutants, Bridges and Brehme (1944)].

2. Morphoses which constitute a complete departure from the organ they replace although the origin by transformation of this organ, or parts of it, is still visible. An extreme example of this is the hereditary replacement of the forelegs of Drosophila by a labium-like structure as described by Goldschmidt (1949), Goldschmidt, Hannah and Piternick (in press).

3. The so-called homoeotic changes in which a serial, segmental organ is replaced by another member of the series. Dorsal and ventral serial members are interchangeable. Many such forms are known from teratological literature. In the work on regeneration of a generation ago many cases of homoeotic regeneration have been described. In addition to the work of Herbst the most important contributions are those by Cuénot (1921), Przibram (1910-19), Brecher (1924) on regeneration of legs instead of antennae in different insects. But the best analyzed cases are the

homoeotic mutants of Drosophila, where the condition is hereditary, sometimes as a simple recessive or a simple dominant or based upon more than one locus. Because this important group of facts is not sufficiently known to morphologists, embryologists, and entomologists, the known cases may be recounted: a. Tetraptera (Tshetverikov, 1929), transformation of halteres into wings with a series of all intermediate morphological stages being available. b. Tetraltera (Goldschmidt, 1940); transformation of the wings into haltere-like structures, again with all intermediate stages existing. c. Podoptera (Goldschmidt, 1945; Goldschmidt, Hannah and Piternick, in press; Rapoport, 1942); transformation of the wings into incomplete legs, again with all transitions. A number of genetically different types are known. d. Aristapedia (Balkaschina, 1929); transformation of the arista into a tarsus, with many transitions. Many slightly different alleles known. e. Proboscipedia (Bridges and Dobzhansky, 1933); transformation of part of the proboscis into tarsi (or arista) with many transitions. f. Hexaptera (Herskovitz, 1949); presence of structures on the pronotum which may resemble perfect wings, halteres or legs or some transitional stage between them. g. Transformation of part of the eye into a palp-like structure (a number of different mutants, e.g., Glass (1949), Goldschmidt (1940), Valadares (1937)). h. The last addition (Piternick, not yet published), where the entire antenna is replaced by a complete leg.

Although in the cases just enumerated the heteromorphosis is hereditary, it is not always so. Some of the types can also be produced as non-hereditary "phenocopies" by environmental action (see Goldschmidt, 1938; Rapoport, 1947; Gloor, 1947). We know now (Goldschmidt, 1929, 1935 a.o.) that the phenotype of practically every morphological mutant known can also be produced experimentally as a non-hereditary phenocopy and one may safely predict that, vice versa, all non-hereditary variations, heteromorphoses or otherwise, which appear in experimentation or as freaks, may also occur as hereditary mutants. Mutant and phenocopy both indicate the possible range of variation in development still producing an organized whole, whether caused by environmental action or by a genetic change. They are identical in regard to morphogenesis, and thus both reveal the potentialities of the organism for morphological change. The primary importance of heteromorphoses, homoeotic mutants and phenocopies for an understanding of the genetic control of morphogenesis, and of variation, as well

as for evolution is obvious. Therefore a presentation of new facts means much more than an addition to a catalogue of teratological phenomena. Bateson (1894) had actually realized this in pre-Mendelian days, long before mutation, homoeotic mutation and phenocopy were known.

Miniature Leg in Genital Region

The first new example was found in a single male which was derived from a cross producing male intersexuality, the so-called Beaded-Minute-Intersexes. In one of these types the external genitalia of the male are completely absent (although portions thereof may be found internally; details in Goldschmidt, 1949) and therefore the ventral surface of the abdomen, frequently considerably enlarged, is very conspicuous. In the male in question a single tiny leg grew out of the combined 6th and 7th abdominal sternites. The leg was rather transparent and very small. It extended only over about half of the right side of the sternite to which it was attached. It did have a complete femur, tibia and tarsus, but hardly any hairs. It was oriented in the proper position of a right leg; a trochanter and coxa could not be seen. A simple sketch was made from the living specimen and it was demonstrated to my collaborator, Dr. L. K. Piternick. Then the specimen was preserved for detailed study after clearing. But in the vial the tiny leg disappeared, probably pulled off its socket by the motion of the liquid. Thus a more detailed description and drawing cannot be given.

A Combined Wing Heteromorphosis

The second heteromorphosis is rather remarkable and especially interesting to the morphologist, embryologist and entomologist. It appeared also in a male from which no offspring was obtained so that it cannot be stated whether a mutant or a modification was present, which, as pointed out above, is not an essential point. The left wing was completely normal, while the right wing showed the heteromorphosis. It was very different from any of the variants found in podoptera and it is clear that it must have been developed in a completely different way. Actually it contained elements of wing, antenna and leg.

Figure 1 shows the structure from the right side. The dorsal contour line of the thorax is shown with only one of the bristles (dorsocentral) included for size reference. The contour of the scutellum is visible below. The basis of the left wing with that portion of the cubital cell not hidden behind the thorax, is outlined.

The heteromorphic wing is attached in the correct place but its attachment is by means of a tiny knob of dark chitin only. The entire structure is not more than about twice as long as the normal cubital cell and about the size of an antenna. Its supporting axial structure consists of a short attachment, two knobs and a long rod, not separated by joints, and made of hard dark chitin covered densely with spines. On the rod these spines are arranged in a row, similar to the arrangement of the spines at the anterior edge of the wing. But these spines are many times smaller than those of the normal wing. Where the second knob connects with the rod a small

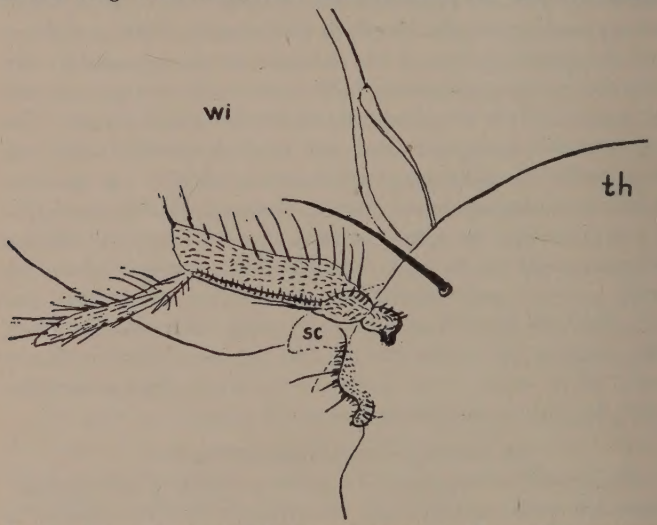

Fig. 1. A combined wing heteromorphosis in *Drosophila melanogaster*.

side-branch is visible which ends in a long stiff bristle. It stretches almost parallel to the rod, extending to one-half of its length. To the rod and second knob a rhomboid plate is attached covered with hairs (not all of them drawn) which are arranged like the hairs on the surface of the wing. The free edge is lined with long slender hairs, similar to the hairs upon the alula. In the position of the drawing this blade is pointing toward the body and the axis of the organ is in a lateral location. I assume that this topography has been distorted somewhat, inasmuch as the axis should be the anterior edge of the structure, with the blade behind it. At the end of the rod a part which looks very much like a foxtail is attached at

an angle. I suspect that this actually represents the continuation and end of the blade and was torn off partly during the eclosion from the pupal case. The spine-like process at the basis of the "fox-tail" fits exactly into the posterior end of the blade and has also the same structure, when viewed at higher magnification. The original topography would thus be obtained if the whole "tail" were moved out of the plane of the drawing, turning it 180° upwards around the point of attachment.

At the posterio-lateral edge of the thorax behind this wing, a differentiation is found in form of a hairy double knob, as drawn. The probable meaning will be discussed below.

Analysis

We ask now whether it is possible to relate the heteromorphic structure to known elements of the wing or another appendage. Actually it can be shown that wing, antenna, and leg elements are all present in the structure. In order to realize this we must remember some of the facts found in the podoptera wing (see Goldschmidt, 1945).

Here the transformation of the wing into a leg with all transitions between the two shows that the wing consists of four parts which behave more or less independently: 1. The costal vein and cell, which transform directly into the leg-like structure. 2. The anterior half of the wing blade, and 3. the posterior part of the blade which are both reduced in different ways down to typical chitinous knobs. 4. The alula (squama) which undergoes comparable changes independently. The heteromorphic wing discussed here is clearly not a variant of the podoptera wing which is always characterized by the typical transformation stages of the costal vein and cell, as illustrated in Goldschmidt, 1945.

In the present case a new type of transformation has taken place which involves only the two anterior sections of the wing. The costal vein and cell have been transformed into the two spiny knobs and their attachment, together representing a variant of the basis of an antenna with its three segments (see below). In the normal costal cell the vein ends with an incision of the wing margin—the point at which in podoptera the leg separates from the wing—and here two larger spines or spurs are located. This end of the costal vein is here transformed into the short process, which carries the long spine. Undoubtedly the long spine corresponds to one branch of an arista, while the process represents the attachment of the

arista to the basal segments. Beyond this point in a normal wing the wing edge is occupied by the marginal vein. It carries spines which are different in size, shape and arrangement from those of the costal vein along the costal cell. Actually this marginal vein is not a continuation of the costal vein but of the first longitudinal vein. (Details in Goldschmidt, 1945.) In the heteromorphic wing, part of this marginal vein is clearly represented by what was described above as the rod to which the wing blade is attached. The anterior section of the wing blade is thus represented by this rod-marginal vein and a rudimentary wing blade which has formed long hairs at its free margin and the "foxtail" at its tip. We shall see at once that the foxtail represents a transition from wing to tarsus, via arista. A completely new and in itself well organized organ, resembling more an antenna than a wing, has been formed.

Actually this comparison is more than only a formal one, as indicated above. If we remove the wing blade from this organ, a structure is obtained which resembles to a certain degree some conditions found in the mutant aristapedia (in which the basis of the antenna looks like the knobs in the present case, and the arista, instead of being transformed into a tarsus resembles somewhat our foxtail).

Figure 2, kindly contributed by Dr. Aloha Hannah, illustrates a new type of aristapedia mutant, found by her. In (a) an antenna is pictured with the three basal segments (scapus, pedicellus and funiculus) and the arista which is not so different from normal. (b) and (c) are more abnormal antennae of this mutant, none of them showing the perfect tarsus which is characteristic of typical aristapedia. In a general way the type resembles or is comparable to the heteromorphic wing structure without the blade. I may add that I have frequently seen abnormal Drosophila legs (in the mutant podoptera) in which the unsegmented tarsus was represented by a structure closely resembling the "foxtail."

There is one more remarkable point. Bridges (Bridges and Morgan, 1923) once found a mutant (since lost) called Pointed wing, in which the antennae were changed in the direction of a wing. The description given shows this mutant to be very similar to the present heteromorphosis. Thus, taking all these facts into consideration, I have no doubt that the heteromorphosis described here has the combined features of the two anterior sections of a wing, with simultaneous partial transformation into an antenna, and also

partial transformation into a tarsus. Thus it represents the most complicated heteromorphosis known in Drosophila, containing simultaneously elements of the change of a wing into an antenna, an antenna into a wing, an antenna into a tarsus, a wing into a tarsus. It illustrates the unbelievably complicated potentialities of a segmental disc and its ability to form in a single step what is to all purposes a completely new organ, perfect in itself, and as such no monstrosity at all.

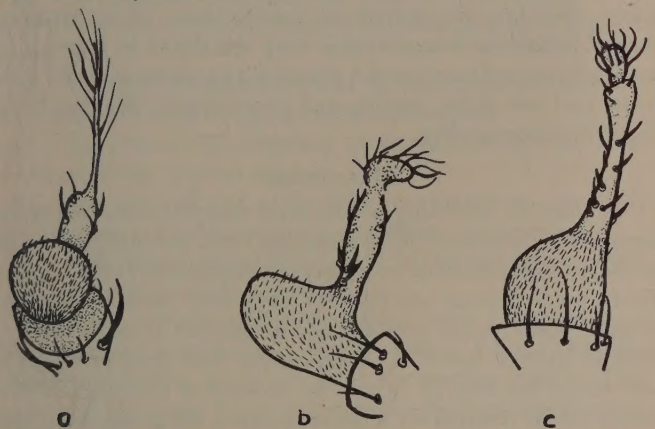

Fig. 2. A new type of aristapedia mutant in *Drosophila melanogaster*.

There is one more point which is of special interest to the entomologist. In an earlier paper (1945) I discussed the fact that the transformations of the podoptera wing show, in partial confirmation of Berlese's views, that the wing consists of four integrated parts, which may become separated. I discussed his views, also the fact that the four sections which are revealed in the podoptera mutant do not agree completely with Berlese's definition (see table 6, p. 92 in Goldschmidt, 1945). Berlese assumed the first section to be precostal and represented by a tegulum, where it exists; his second section comprised most of the wing blade. My first section was the costal cell and the second the anterior half of the wing blade. Since then a number of podoptera flies have been found which have a precostal appendage of the mesothorax. Description and illustrations will be found in a forthcoming paper by Goldschmidt, Hannah and Piternick. Thus my former evaluation of Berlese's scheme should be revised so as to have Berlese's precostal element as the first and to add the costal section, which forms the leg in podoptera,

as the second section. Third and fourth would then be the two sections of the wing blade, as described in the former paper, and the fifth is the alula or squama.

Returning once more to the heteromorphosis of Figure 1, we find it to contain only section two and part of section three of the wing; sections four and five are not represented. In podoptera the sections which have become rudimentary are frequently represented by chitinous knobs of varying structure as described in the earlier paper. This fact now permits an interpretation of the structure located behind the heteromorphic wing and drawn in Figure 1. It is clearly the rudiment of the posterior two sections of the wing (anal part and alula), smaller and more reduced than the knobs found in podoptera flies.

Discussion

It would be interesting to discuss the morphogenetic and evolutionary significance of all the foregoing facts. Discussions of some of the problems involved are found in Goldschmidt (1945) and in Goldschmidt, Hannah and Piternick (in press). An exhaustive discussion would require presentation and analysis of all the facts of heteromorphosis and of the experimental work done in the field, and would also have to include the problem of homology. Therefore it will be reserved for a future occasion. But it may be of help to others interested in the subject and not at home in genetical literature if we recount in a comparative way the heteromorphic replacements known thus far, and the complete or partial transformations of segmental appendages known in Drosophila.

1. The arista of the antenna may be replaced by a complete tarsus or by all transitions between arista and tarsus (aristapedia mutant and alleles).

2. The entire antenna may be replaced by a complete leg in which it seems that the scapus of the antenna forms the trochanter, the pedicellus the femur, the funiculus the tibia, and the arista the tarsus. (Details not yet worked out.)

3. The antenna may transform into an anterior wing margin to which a little wing blade, supposedly the anterior section, is attached (mutant Pointed wing).

4. The wing may, as a whole, be transformed into a haltere through all transitional stages (mutant tetraltera).

5. This haltere may be transformed into a leg without a tarsus (the same).

6. The haltere may be transformed through all transitions into a wing (mutant tetraptera).

7. Segments normally without appendages may grow legs (present first case) or legs, wings, halteres and combinations (mutant hexaptera).

8. The costal cell of the wing may be transformed into a leg without tarsus (mutant podoptera).

9. The precostal wing elements (tegula) may appear, where not normally present, in the form of palp-like structures (mutant podoptera).

10. The three postcostal parts of the wing may be independently reduced to palpi or knobs (mutant podoptera).

11. The costa of the wing may be transformed into the basic antenna segments (present case).

12. The marginal part of the wing edge may form a structure corresponding to an arista and also to a tarsus (present case).

13. Oral lobes of the proboscis may be changed into an arista or a tarsus (mutant proboscipedia).

Important experimental-embryological work has been done with the mutant aristapedia by Braun (1940), Villee (1943-45), Waddington (1939), and Vogt (1946). Its bearing on some of the problems of homoeosis is being discussed in the forthcoming paper by Goldschmidt, Hannah and Piternick.

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FOUR NEW MOSQUITO RECORDS FROM UTAH
(Diptera: Culicidae)

DON M. REES and LEWIS T. NIELSEN
University of Utah, Salt Lake City

In October, 1934, April, 1942 and January, 1944, the available mosquito records for Utah were published by the senior author in this Journal. The following constitutes four new species records for Utah which extend to thirty-six the species reported as occurring in the state.

The writers are indebted to the University of Utah Research Committee for granting funds to aid in conducting further investigations of the mosquito fauna of the mountains of Utah. The two new *Aedes* records reported herein were obtained as a result of this study.

Unless otherwise indicated the collections were made by the writers.

AEDES IMPIGER (Walker)

This species is fairly common in northern Utah at elevations ranging from 6,000 to 9,000 feet. It has been taken only in areas along mountain streams and chiefly in or near willow growths. It is a one-brooded species, the larvae appearing in April, May and early June depending upon the elevation. It is an annoying pest in some localities, but persists for only a short time. No females have been collected in Utah after the first of July.

Salt Lake County: Giles Flats, Big Cottonwood Canyon, May 7, 1949; Brighton, June 13, 1948. Summit County: Lemon's Grove, Provo River, May 1, 1948; Park City, April 24, 1949; Smith and Morehouse Reservoir, May 28, 1949; Soapstone Ranger Station, Provo River, April 23, 1947. Wasatch County: Jordenelle, Provo River, April 16, 1949; Stewart's Ranch, Provo River, May 1, 1948.

Aedes nearcticus Dyar

This mosquito has been collected in only one locality in Utah. Larvae and adults were found in an alpine meadow at an elevation of 10,100 feet in the Uintah Mountains. This is a true arctic species and although rare in Utah, is probably found throughout the Uintah Mountain Range wherever suitable alpine conditions occur. Because of its restricted distribution it is not of pest importance in Utah.

Summit County: Wall Lake, Uintah Mountains, July 5, 1947 (E. J. Roscoe), July 12, 1947.

Culex apicalis Adams

This species is represented by a single larval specimen taken at Kamas, Utah, at an elevation of 6,400 feet. It is probably more widely distributed in Utah than this single record would indicate.

Summit County: Kamas, July 4, 1948 (F. C. Harmston).

Culex quinquefasciatus Say

Males of this species were found by the writers amongst unidentified material in the University of Utah collection. Only two localities are recorded but as they represent both northern and southern areas of the state it is likely that the species is distributed throughout Utah in the lower valleys at elevations below 5,000 feet.

Salt Lake County: September 24, 1940, September 10, 1943.
Washington County: St. George, October, 1938.

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DETERMINATION OF SEX IN ADULT RICE AND GRANARY WEEVILS

(Coleoptera: Curculionidae)

D. Bap Reddy

University of California, Berkeley

The rice weevil, *Sitophilus oryzae* (L.) and the granary weevil, *S. granarius* (L.) are the most important destructive members of the genus *Sitophilus*. These insects are very small and resemble each other in general form and biology, but can be easily distinguished from one another. In contrast to the granary weevil, the rice weevil is smaller, has four rufous spots on the elytra, possesses functional wings and the punctuations on the body are circular instead of oblong.

Although the species can be easily distinguished, the separation of the sexes based upon external morphological characters offers a more difficult problem. Therefore, an investigation was conducted to determine what characters might be useful in separating the sexes. Male and female weevils of both species, about two months old, were secured from a mass culture maintained at room conditions. Adults were etherized before they were measured. The body length (prothorax and abdomen) and the width of the rostrum (middle part) were measured in dorsal aspect. The length of the rostrum, including the base of the eyes to the tip of the mandibles, was measured in lateral aspect. It should be mentioned here that it is very important to make measurements in the same aspect for each part in each individual. In making measurements a binocular microscope equipped with an eye piece micrometer was used. More than 50 individuals of each sex of each species were measured. The characters on the rostrum can be easily seen when the weevil is held dorsally on the forefinger with the thumb covering the abdomen and thorax and then placing it under a binocular of high magnification in the presence of bright light.

It was found that the body length was of no value in determining the sexes. It was also observed that the age and size of the weevils influenced the size of the rostrum, but this influence became very insignificant as adults reached maturity. The useful characters in separating the sexes, however, were found to be present in the rostrum and the tip of the abdomen.

The male rostrum is comparatively shorter and wider as compared to the narrower, longer and more cylindrical rostrum of the female. In this regard Birch (1944) observed that the rostrum of the male rice weevil was shorter and thicker. Also, in the male the dorsal surface of the rostrum is closely and strongly punctured whereas in the female the punctures are superficial and sparse and rarely occur on the distal end. Richards (1947) separated the male rice weevil from the female on the basis of punctures on the rostrum. These distinguishing differences between the sexes are shown in figure 1. It should be pointed out here that the difference in the density of punctures on the rostrum of male and female granary weevils is not so well marked as is in case of rice weevils. With some practice, however, the female granary weevil can be easily distinguished from the male by the presence of a more slender and cylindrical rostrum.

TABLE 1

Measurements of rostri of male and female rice and granary weevils.

Species	Sex	Length of the rostrum in mm.		Width of the rostrum in mm.		Ratio of width of the rostrum to the length of the rostrum	Ratio of lengths of male rostrum to female rostrum	Ratio of widths of male rostrum to female rostrum
		Range	Average	Range	Average			
Rice weevil	Male	0.785- 1.075	0.893	0.161- 0.200	0.179	1.0 : 5.0	1.0 : 1.2	1.2 : 1.0
	Female	0.856- 1.200	1.036	0.133- 0.163	0.147	1.0 : 6.9		
Granary weevil	Male	0.875- 1.250	1.063	0.175- 0.225	0.207	1.0 : 5.1	1.0 : 1.4	1.6 : 1.0
	Female	0.963- 1.330	1.176	0.150- 0.187	0.169	1.0 : 6.9		

A clear picture of the relation between sizes of rostri of male and female weevils can be obtained from table 1. In both species the male rostrum is shorter and wider than that of the female. It is also seen from the table that in the male and the female the ratio between the width and the length of the rostrum is approximately the same in each species. The ratio between lengths or widths of male and female rostri, however, is not equal and varies slightly in each species. In the female the range of variation in the width of the rostrum is less than is that in the male although the variation in the length of the rostri is equally great in both sexes.

In addition to the above characters the male rostrum is much less curved than is that of the female. This is most apparent when individuals are viewed from the side. Also when seen from the

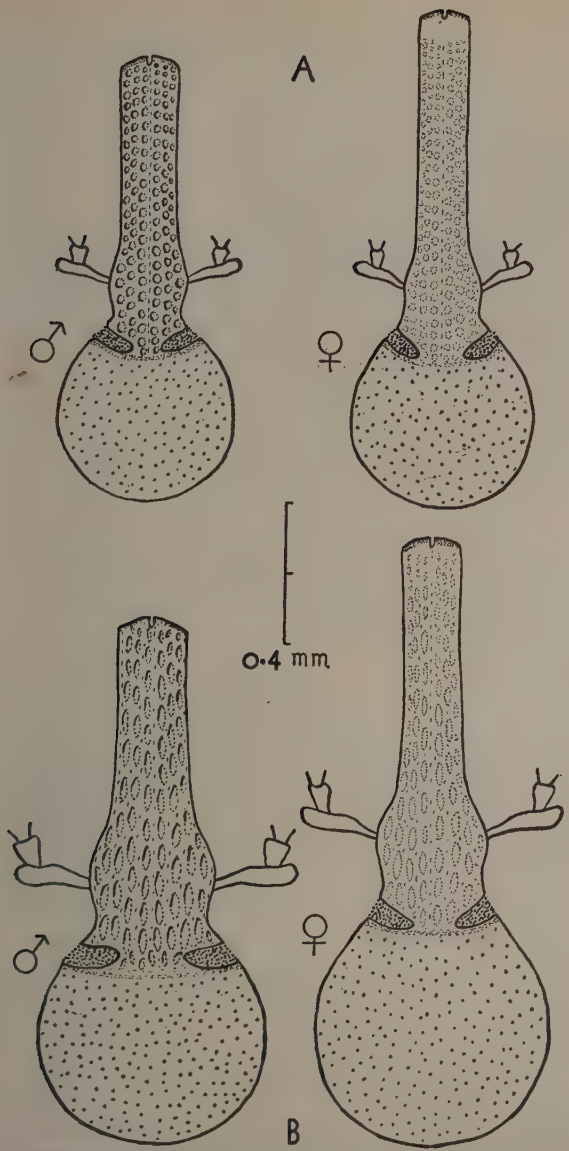

Fig. 1. Rostri of male and female weevils. A, the rice weevil *Sitophilus oryzae* (L.); B, the granary weevil, *S. granarius* (L.).

dorsal aspect the male rostrum is slightly narrower in the center and wider at the ends than is that of the female. The female rostrum, particularly the anterior part, when viewed under a strong light appears brighter. This is especially true in the case of the rice weevil where the rostrum is lightly punctured, the distal end being almost devoid of punctures.

Although not as suitable as the characters given for the rostrum, the shape of the last abdominal sternite can be used to separate the two sexes. Richards (1947) used this character to distinguish male and female granary weevils. He found that in the male the sternite is more ventrally flexed than in the female. While this character is not so pronounced in the rice weevil it can be used in separating the sexes.

Hundreds of adults of both species which were sexed on the basis of characters of the rostrum mentioned above were dissected to verify the sex and in all cases examined, these characters held true.

Summary:—In both the rice weevil and the granary weevil the male rostrum is comparatively shorter and wider and its dorsal surface is closely and strongly punctured as compared to the female rostrum which is longer, thinner and more cylindrical in form, the punctures being superficial and sparse, rarely occurring on the distal end.

Acknowledgments:—I wish to express my deepest gratitude to Dr. A. E. Michelbacher for reading the manuscript, making helpful suggestions and for guiding the work during the investigation. Acknowledgments are made to professors E. O. Essig and E. G. Linsley for help and suggestions, and to the former for providing the facilities. The valuable help of Miss M. Moeller and the suggestions of Mrs. F. Abernathy in making drawings are sincerely appreciated.

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HISPELLA A SYNONYM OF HISPA LINNAEUS, AND A NEW DACTYLISPA FROM CHINA

(Coleoptera: Chrysomelidae)

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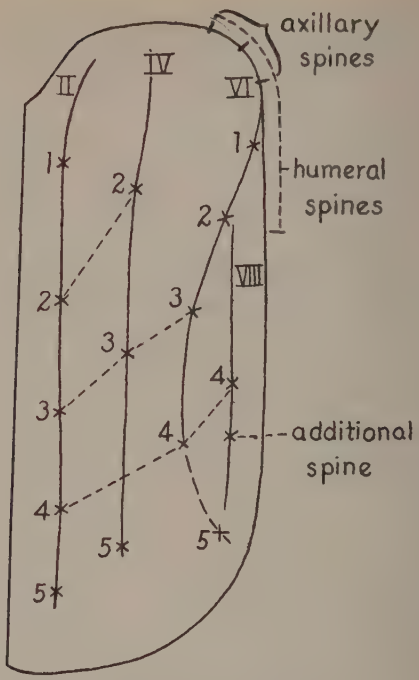
This note records comparisons recently made by Dr. Erich Uhmann (Stollberg, Saxony, Germany) of types of two described species of spiny Hispinae of the genus *Dactylispa*, with a new species from China. This new form, below named *Dactylispa luhi*, was reared by C. J. Luh of the National Tsing Hua University, Peiping, China, from a grass, *Arthraxon hispidus* (Thbg.), a variety of which now occurs in 10 or more States in North America. It also seems proper at this time to object to the misuse of the generic name *Hispa* by Chapuis in 1875, whose error has been followed unquestioned by his successors for three-quarters of a century.

Hispa Linnaeus 1767 (Syst. Nat. vol. 1, pt. 2, p. 603) included four species, of which the fourth is now catalogued in the Colydiidae, the third was placed in *Paussus* by Schoenherr, 1817 (Syn. Ins., vol. 3, p. 19), while the first two remain in the subfamily Hispinae. Latreille, 1810 (Consid. Gen., p. 432), designated (fide Opinions 11 & 136) the type of *Hispa* as *Hispa atra* Fab., and since Fabricius cites Linnaeus' original description the record automatically falls upon Linnaeus' first species, which was also cited as the genotype by Kirby, 1837 (in Richardson, Fauna Boreali-Americana, p. 227) and by Westwood, 1838 (Introduct. Modern Class. Insects, vol. 2, Synopsis, p. 42). The date of the part last cited is often erroneously given as 1840.

These type designations were ignored by Chapuis, 1875 (in Lacordaire, Hist. Nat. Ins., Gen. Coleop., vol. 11, p. 334). He erroneously cited *Hispa testacea* as type of *Hispa* and proposed a new generic name, *Hispella*, citing as its type *H. atra* L., which is the previously designated type of *Hispa* L. Thus *Hispella* Chap. is an isogenotypic synonym of *Hispa* L., and we must find a different name for the group which has been miscalled *Hispa* for about 75 years.

[1]Mr. Barber died on June 1, 1950.



Dactylispa luhi Uhmann

Although subdivision of old genera now seems prevalent, restudies of adequate material often lead to synonymy of names proposed for supposedly distinct groups. If *Thoracispa* Chapuis, 1875 (l.c. p. 335), type *T. dregei* Chp., 1875 (validated by his remarks on p. 336 but dated by Weise, 1911, in Junk Cat., pt. 35, p. 74, as from its second description in 1877), were to remain in the group called *Hispa* by Weise, that name should be adopted. But since Dr. Uhmann tells me *Thoracispa* must be regarded as generically distinct, the choice of a name to supplant *Hispa* Chapuis, Weise, and others would fall on *Dicladispa* Gestro, 1897, with *Hispa aenescens* Baly, 1887, as its type (this latter specific name is regarded as a synonym of *Hispa armigera* Olivier, 1808).

Dr. Uhmann's notes and illustration are adopted in the following description.

Dactylispa luhi Uhmann, new species

Similar to *D. assamensis* Weise but narrower, with slenderer antennae when examined from either their broad, or their narrow sides. In the latter aspect (dorsal) segment 3 is longer than in *assamensis;* 4 and 5 are longer than broad; 6 is not broader than long, 7 is longer than broad. In their broader (lateral) aspect segments 3, 4, 5 are distinctly longer than broad and without visible longitudinal channels while in *assamensis* all segments except 3 and 11 are broader than long and 3 to 6 are distinctly longitudinally sulcate. Prothoracic spines more slender but placed as in *assamensis.* Elytral spines in oblique series (see figure) : interstice II with spines 1-5; IV 1 is lacking, IV 2 far forward, only a little posterior to II 1; IV 3 and IV 5 also much forward of II 3 and II 5; IV 4 lacking; humerus with 5 spines as in *assamensis,* VI 1, VI 2, behind the three axillary or prehumeral spines, VI 3 and VI 4, closer to the suture and VIII 4, VIII 5 close to the margin with an additional spine between them which is not present on *assamensis.* Length, 3.1 mm.

This species, *luhi,* differs greatly from the lectotype of *D. pusilla* Weise; the antennae are much more slender, the thoracic and elytral spines are slenderer and longer.

Holotype, U. S. National Museum, cat. no. 59393.

Reared by C. J. Luh of Peiping, China, from *Arthraxon hispidus* (Thbg.) under his experiment number 3561, but the type locality was not stated by him. He was near Kunming, Yunnan, in Southwestern China during the war.

A HOMONYM IN THE GENUS THRIPS LINNÉ

(Thysanoptera: Thripidae)

About ten years ago a case of homonymy was noted in *Thrips setosus* Moulton, 1929. At this time Mr. Moulton's attention was called to the condition but it appears not to have been corrected. *Thrips setosus* Moulton, 1928 (Annotationes Zoologicae Japonenses 11(4) :304-305. Dec. 20) has priority over *Thrips setosus* Moulton, 1929 (Records of the Indian Museum 31(2) :97-98. July). *Thrips setosus* Moulton, 1928, was described from Osaka, Japan, and the type is in the Moulton collection (No. 2358). For the homonym, *Thrips setosus* Moulton, 1929, nec *setosus* Moulton, 1928, I propose herewith the name *temporatus.* The unique type of *temporatus* Bailey, *nom. nov.* (Moulton No. 2002) is in the Indian Museum, Calcutta.—Stanley F. Bailey, Davis, California.

OBSERVATIONS ON RHOPALOMYIA CALIFORNICA FELT
(Diptera: Itonididae)

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GALLS: This species forms many-chambered galls on the plant terminals; a few single-chambered galls on the leaves seem also to be made by it. The host is chaparral broom (*Baccharis pilularis* D. C.), both the prostrate coastal subspecies *typica* C. B. Wolf, and the erect inland subspecies *consanguinea* D. C.

Sectioned and stained galls show a matrix of parenchyma-type cells that forms the mass of the gall. The larval chambers are tubular, closed distally and of mechanical tissue. This tissue is absent distally and apparently also inwardly, though this is less certain.

Cross sections show numerous small vascular bundles, the apparent medium of food and water exchange for the gall. These bundles appear to be those of the petioles and veins of the undeveloped leaves that are involved in the gall. This conclusion is based on two considerations: first, that the bundles are concentrically arranged as in the bud, and second, that the xylem is internal and the phloem external as in the petioles of normal leaves.

The epidermis of the gall is composed of from one to three, usually two, layers of cells. The larval chambers are closed distally by a few layers of cells. No open chambers with developing larvae were found.

EGGS: Eggs are laid on the terminals, usually on the buds. The newly hatched larvae enter between the bud scales, by pushing in between the unopened leaves. No gall is formed until after the larvae enter, so it is concluded that the stimulus for gall formation is the entry of the larvae and not oviposition. Oviposition is largely external, and apparently eggs are not inserted into the tissue, although they may be placed under partly opened leaves.

LARVAE: Minute larvae may crawl for some distances, apparently at random. By no means do all of the young larvae gain entry; many wander until they die. Oviposition is profuse but galls are relatively few-chambered. The mortality rate of young larvae is high; only a few become established. The communal galls seem to be a random result, caused by the entry of several larvae into one bud. The gall that is stimulated by this mass entry eventually en-

velopes all the larvae in any given bud. The concentric arrangement of the chambers of the gall seems to evolve from the concentric arrangement of the bud leaves.

Since the galls are closed, the suggestion is made that the larvae obtain oxygen through or from the tissues of the plant. Superficial tissues of the galls are rich in chloroplasts, and a possible explanation (by no means proven) is that the oxygen that results from photosynthesis may enter the larval chambers. Further plausibility is furnished by the fact that the cells closing the galls are photosynthetic.

Larvae face the inner end of the chamber. The method of obtaining nourishment is not clear. The mechanical structure of the gall and the structure of the larvae suggests that food is liquid in nature. Observations begun by another observer to clear up this point have not to date led to any conclusion.

Prior to pupation, the larva turns in the cell and faces outward. This was not observed in fact, but since the developing larvae face inward while the pupae face outward, such a turning must occur. Because of the opacity of the galls, and their tendency to wither, no accurate information was obtained as to number of larval instars and length of pupal period, but indications are that the instars are few and the pupal period short.

PUPAE: The pupa is equipped with a cephalic projection which serves to push through the cells that close the chamber. The pupa appears at the outer end of the cell and gradually protrudes. Protrusion continues until but a few abdominal segments remain in the cell. Then the pupal skin splits irregularly and the adult emerges. Emergence is at first without evident movement, the adult slowly squeezing out by translocation of body fluids, by ingestion of air, or by both. When the adult is far enough out to free any appendages, these are moved slowly and soon become functional. Frequently adults crawl onto the gall to sit while their tissues harden. Emergence takes but a few minutes. The pupal skin remains hanging to the gall.

ADULTS: Newly emerged adults mate almost at once. Mating is brief. Males are short lived. In a typical instance, mating occurred at 9:00 A. M. and the male died at 12:20 P. M. This male had

emerged at 8:00 A. M. and so had an adult life span of four hours and twenty minutes.

Newly emerged females are distended with eggs. The vermillion colored eggs give the abdomen of the female an orange color. After oviposition, the female is slender in form and dusky in color. Oviposition is rapid and begins soon after mating. While eggs are mostly laid on the tips, some may be laid at some distance down the stems. In nine instances, the average number of eggs was 146, but in each case unlaid eggs remained. Dissections of three females just prior to egg laying showed an average of 279 eggs in the abdomens. It would appear that this maximum number is seldom laid. This tendency not to lay all of the eggs that are developed appears to be common to many species of insects of diverse orders.

The gut of adults of this fly is greatly reduced and appears to be non-functional. None was seen to pass any excrement.

The life span of the female exceeds that of the male, the longest survival time observed being fifty-two hours. The mouthparts seem to perform no function; none was observed to take either food or water.

PARASITES: This fly is heavily parasitized. The following parasites were reared: *Torymus baccharidis* (Huber); *Amblymerus* n. sp., *Eupelmus inyoensis* Girault *Eupelmus* sp., *Tetrastichus* sp., *Platygaster* sp. Some of these are undoubtedly secondary, but their exact status is at present not known.

ACKNOWLEDGMENT: Mr. C. F. W. Muesebeck of the United States National Museum was so kind as to identify the parasites.

LEPIDOPTERISTS' SOCIETY

It is with great interest that we note the organization of the Lepidopterists' Society. Installed as officers were J. H. McDunnough as president, A. H. Clark as senior vice-president, J. B. Ziegler as treasurer, and F. H. Rindge as secretary. The society held its first annual meeting in New York on December 29th and 30th and certain aspects of the meeting have been reviewed in the New Yorker magazine for January 13, 1951. Those interested in membership or in additional information should address their communications to Dr. F. H. Rindge, Department of Insects & Spiders, American Museum of Natural History, Central Park West at 79th Street, New York 24.—PAUL D. HURD, JR.

A CHECK LIST OF THE TICKS OF UTAH

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This paper provides a distributional list of the ticks of Utah, with their hosts. Approximately 650 specimens of ticks have been examined from Utah comprising representatives of 19 of the 21 species listed. Specimens of *Ornithodoros eremicus* Cooley and Kohls[5]† and *Ixodes diversifossus* Neumann, Stanford[12], previously reported from Utah, were not available for this study.

The writer is indebted to Glen M. Kohls of the U. S. Public Health Service, Rocky Mountain Laboratory, Hamilton, Montana, for verification of identifications; also to F. C. Bishopp of the Bureau of Entomology and Plant Quarantine for his assistance in obtaining literature and further references, and to Don M. Rees of the University of Utah for guidance and aid during this study. The study was made possible by a research grant from the University of Utah Research Committee.

In this report the collection records are arranged alphabetically by county. Unless otherwise indicated, all records listed as new are of specimens now in the collection of the University of Utah. In the lists of specimens examined, abbreviations are employed as follows: (U.S.A.C.) Utah State Agricultural College; (R.M.L.) Rocky Mountain Laboratory; (U.S.P.H.S.P.L.) United States Public Health Service Plague Laboratory.

1. *Argas reflexus* (Fabricius).—NEW RECORDS: Uintah County, 3 mi. S. Vernal, July 27, 1948, cliff swallows (C. Greenhall). These specimens were immature forms, and were labeled "probably *reflexus*" at the R.M.L.

2. *Argas persicus* (Oken).—RECORDS FROM LITERATURE: Tooele County, Tooele, Apr. 18, 1934, chickens (G. F. Knowlton), Bishopp and Trembley[2]; Washington County, "near" St. George, 1936, chickens (E. W. Davis), Cooley and Kohls[7].—NEW RECORDS: Kane County, 5 mi. NW. Kanab, May 18, 1947, long tailed chat (J. C. Downey); Salt Lake County, 3 mi. E. Salt Lake City, 1948, fox sparrow (R. Selander).

3. *Otobius megnini* (Duges).—RECORDS FROM LITERATURE: The following authors list this tick as occurring in Utah without giving specific collection data: Hunter and Bishopp[10], Bishopp and Trembley[2], Cooley and Kohls.[7] NEW RECORDS: Emery County, San Rafael

*Contribution from the Division of Biology, Department of Invertebrate Zoology and Entomology, University of Utah, Salt Lake City, Utah.

†The collection records from the literature are followed by the author's name and a number, referring to the number of the reference in the bibliography. The names placed in parentheses are those of the collectors of the specimens.

Desert, Aug. 16, 1947, calf (B. Moore); San Juan County, Dry Mesa, Oct. 27, 1946, deer (J. Berryman); Sanpete County, Wales, Oct. 19, 1946, deer (D. M. Rees); Washington County, Beaver Dam Wash, May 6, 1941, host unknown (J. Berryman).

4. *Ornithodoros eremicus* Cooley and Kohls.—RECORDS FROM LITERATURE: San Juan County, "near" Bluff, Aug. 24, 1939, *Peromyscus maniculatus*, Cooley and Kohls.[5]

5. *Ornithodoros turicata* (Duges).—RECORDS FROM LITERATURE: San Juan County, "near" Monticello, Aug. 31, 1940, burrow of *Citellus* sp. (R.M.L.), Cooley and Kohls[7]; Washington County, Beaver Dam Slope, 1939, *Gopherus agassizi*, Woodbury and Hardy.[13]

6. *Ornithodoros parkeri* (Cooley).—RECORDS FROM LITERATURE: Collections from Carbon, Emery, Grand, Iron, Uintah, and San Juan Counties reported by Davis.[9] NEW RECORDS: Washington County, Beaver Dam Slope, Sept., 1939, tortoises (A. M. Woodbury).

7. *Ornithodoros kelleyi* Cooley and Kohls.—RECORDS FROM LITERATURE: Grand County, 4 mi. N Thompsons [sic], July 31, 1940, *Pipestrellus* bats (J. Frenkle), Cooley and Kohls.[6]

8. *Ornithodoros talaje* (Guérin-Méneville).—NEW RECORDS: Kane County, "near" Echo Cliffs, Navajo Indian Reservation, Sept., 1939. Found unattached under a rock (S. and D. Mulaik).

9. *Ixodes sculptus* Neumann.—RECORDS FROM LITERATURE: Rich County, May 20, 1938, *Citellus armatus* (Eskey); Summit County, June 15, 1938, *Citellus armatus* (Eskey); June 13, 1938, *Citellus armatus* (Eskey), Cooley and Kohls.[8] NEW RECORDS: Cache County, Logan Canyon Forestry Camp, Mar. 23, 1942, *Citellus armatus* (J. S. Stanford), U.S.A.C.; San Juan County, Abajo Mts., 5 mi. W. Monticello, July 5, 1947, pocket gopher (L. R. Edmunds); Dalton Spring, Abajo Mts., 5 mi. W. Monticello, July 5, 1947, pocket gopher (L. R. Edmunds); Gooseberry Ranger Station, Elk Ridge, July 14, 1947, pocket gopher (L. R. Edmunds).

10. *Ixodes pacificus* Cooley and Kohls.—RECORDS FROM LITERATURE: Beaver County, Bush Creek, Oct. 20, 1938, human (Thorne); Washington County, "near" Pinto, Oct. 20, 1938, human (D. M. Rees); Bishopp and Tremble.[2] NEW RECORDS: Millard County, Holden, Oct. 25, 1945, human (D. M. Rees).

11. *Ixodes marmotae* Cooley and Kohls.—RECORDS FROM LITERATURE: Cache County, May 24, 1938, *Citellus armatus* (U.S.P.H. S.P.L.); Rich County, June 3, 1938, *Marmota* sp. (U.S.P.H.S.P.L.), Cooley and Kohls.[8] NEW RECORDS: Box Elder County, "near" Lampo, July 9, 1942, *Marmota* sp. (J. S. Stanford), U.S.A.C.; Salt Lake County, Prairie Hollow, May 18, 1939, *Marmota* sp. (L. R. Edmunds).

12. *Ixodes kingi* Bishopp.—RECORDS FROM LITERATURE: Grand County, Sept. 1, 1940, prairie dog (R.M.L.); Sept. 2, 1940, prairie dog (R.M.L.); Millard County, Aug. 9, 1940, prairie dog (R.M.L.); Sept. 9, 1940, prairie dog (R.M.L.); San Juan County, May 1, 1937, prairie dog (Haas); Apr. 22, 1937, *Mustela* sp. (Haas); Apr. 21,

1937, *Mustela* sp. (Haas), Cooley and Kohls.[8] NEW RECORDS: San Juan County, July 4, 1947, prairie dog (L. R. Edmunds).

13. *Ixodes angustus* Neumann.—NEW RECORDS: Cache County, Sardine Canyon, Dec. 28, 1937, weasel (Denning), U.S.A.C.; Camp Hunt, Aug. 14, 1942, shrew (J. S. Stanford), U.S.A.C.; Uintah County, Paradise Park, Aug. 7, 1947, pika (K. R. Kelson).

14. *Ixodes ochotonae* Gregson.—NEW RECORDS: Uintah County, Paradise Park, July 31, 1947, pika (G. F. Edmunds, Jr.); July 22, 1947, pika (K. R. Kelson); July 30, 1948, pika (D. M. Rees).

15. *Ixodes spinipalpis* Hadwen and Nuttall.—NEW RECORDS: Uintah County, 1 mi. SE. Ouray, 1946 (J. Berryman), host unknown. These specimens were labeled "probably *spinipalpis*" at the R.M.L.

16. *Ixodes diversifossus* Neumann.—RECORDS FROM LITERATURE: Cache County, "near" Logan, July 28, 1931, cottontail rabbit (J. S. Stanford).

17. *Dermacentor albipictus* Packard.—RECORDS FROM LITERATURE: Bishopp and Trembley[2], Cooley[3], report this tick as occurring in Utah, without giving specific collection data. NEW RECORDS: Cache County, Logan, Feb. 5, 1942, deer (Clamaine); Logan, Oct. 27, 1947, deer (Hobbs), U.S.A.C.; Daggett County, 18 mi. E. Linwood, Mar. 12, 1947, antelope (K. R. Kelson); Garfield County, Panguitch, March, 1948, horse (L. R. Edmunds).

18. *Dermacentor parumapertus* Neumann.—RECORDS FROM LITERATURE: Bishopp and Trembley[2], Cooley[3], show this species on their distribution maps; Juab County, Trout Creek, May 6-8, 1934, jack rabbit (J. S. Stanford), Stanford.[12] NEW RECORDS: Kane County, 2 mi. SW. Kanab, May 20, 1947, jack rabbit (J. C. Downey); 3 mi. S. Kanab, May 23, 1947, jack rabbit (G. K. Todd); Kanab, May 24, 1947, jack rabbit (J. C. Downey); 2 mi. S. Kanab, May 24, 1947, jack rabbit (J. C. Downey); Hamblin Ranch, Cave Lakes Canyon, 5 mi. NE. Kanab, May 18, 1947, cottontail rabbit (G. K. Todd); House Rock, Arizona-Utah border, May 5, 1947, jack rabbit (L. R. Edmunds); San Juan County, 11 mi. N. Bluff, June 28, 1947, jack rabbit (L. R. Edmunds); Tooele County, Rush Valley, Dec. 30, 1947, jack rabbit (I. Bell).

19. *Dermacentor andersoni* Stiles.—RECORDS FROM LITERATURE: Many authors record this species in Utah. NEW RECORD: The most abundant tick in Utah, records are from the following counties: Cache, Davis, Duchesne, Emery, Garfield, Iron, Kane, Millard, Salt Lake, San Juan, Sanpete, Tooele, Utah, Wasatch. Numerous host species were recorded.

20. *Haemaphysalis leporis-palustris* (Packard).—RECORDS FROM LITERATURE: Box Elder County, July 22, 1931, pigmy rabbit (J. S. Stanford), Stanford.[12] Other authors show distribution on maps, Bishopp and Trembley,[2] and Hunter and Bishopp.[10] NEW RECORDS: Emery County, 4 mi. N. Green River, June 22, 1947, cottontail rabbit (L. R. Edmunds); 4 mi. N. Green River, June 22, 1947, cottontail

rabbit (L. R. Edmunds); Grand County, Valley City, June 23, 1947, cottontail rabbit (L. R. Edmunds); Salt Lake County, Mill Creek Canyon, July 21, 1946, jack rabbit (H. Stark); San Juan County, 18 mi. E. Monticello, July 1, 1947, cottontail rabbit (L. R. Edmunds).

21. *Rhipicephalus sanguineus* (Latreille).—RECORDS FROM LITERATURE: Salt Lake County, Salt Lake City, May 15, 1943, dog (R.M.L.). Kohls and Parker.[11] NEW RECORDS: Salt Lake County, Salt Lake City, Oct., 1947, Mexican dog, [*sic*] (collector unknown).

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NEW SPECIES OF COLEOPTERA FROM NORTH AMERICA

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California Academy of Sciences, San Francisco

CARABIDAE

Feronia (Cryobius) bryanti Van Dyke, new species

Small, narrow and elongate, moderately flattened, black and shining, legs rufous. *Head* somewhat longer than broad, as wide as apex of prothorax, front smooth, frontal grooves straight and well impressed; mandibles prominent, porrect; eyes moderately prominent; antennae long and delicate, extending backwards beyond base of elytra. *Prothorax* as broad as long, apex feebly emarginate, sides broadly arcuate in front, obliquely narrowed behind or sometimes feebly sinuate to obtuse hind angles; disc with median longitudinal line finely impressed, anterior transverse impression well defined, posterior transverse impression less evident, basal impressions linear and lunate in front, broad and deep behind, faintly double, basal area quite smooth, hind angles obtuse, base feebly emarginate and without margin. *Elytra* elongate, slightly cordate, broad at base with humeral angles prominent and well rounded, the sides almost parallel, broadly rounded posteriorly and feebly sinuate towards apex; disc feebly convex, more or less flattened, striae well impressed throughout and practically impunctate, the intervals convex, the third with three foveae. Legs long and delicate. Prosternum not margined apically. Male front tarsi well developed. Length 8.0 mm., breadth 2.75 mm.

Holotype male, *allotype* female (Nos. 6197 and 6198, California Academy Sciences, Ent.) and one male *paratype*, all collected by Owen Bryant, at AKLAVIK, MACKENZIE DELTA, NORTHWEST TERRITORY, Canada, June 16, 1931 (Bryant Lot 233).

This small *Platidius*-like beetle is closely related to *Feronia blaisdelli* Van Dyke (Pan-Pacific Ent., 19(1):24-25. Jan. 1943) but differs principally by having the sides of the prothorax oblique posteriorly and with obtuse hind angles, whereas *blaisdelli* has the sides of prothorax strongly sinuate posteriorly and the hind angles right-angled; the elytra rather cordate in shape with prominent humeri as against an elliptical afterbody with narrowed and oblique humeri; and well-impressed striae and convex intervals in contrast to the more feebly impressed striae and somewhat flattened intervals. The two species stand well apart from all other American species of the subgenus *Cryobius*.

ELATERIDAE

Athous farallonicus Van Dyke, new species

Elongate, subparallel, moderately convex, upper surface brown, the elytral suture and lateral margin, the underside, legs and antennae somewhat rufous. *Head* rather coarsely closely punctured, the front deeply triangulately impressed anteriorly, clypeal margin prominent, transverse, eyes large; antennae filiform, reaching in males two segments beyond hind angles of prothorax, in females barely to hind angles, the second segment small, but little longer than broad, the third almost twice as long as second and triangular, the fourth and fifth somewhat more robust, about one-and-a-half times as long as broad and feebly serrate, the sixth to tenth a bit longer, more parallel and gradually narrower and the eleventh elongate fusiform. *Prothorax* about a sixth longer than broad, apex feebly arcuate, base emarginate, sides sinuate behind, feebly arcuate in front and slightly narrowed at apex, apical angles blunt, not projecting, hind angles acute, without carinae, with sides elevated and extending somewhat backwards, the lateral margins narrow; the disc rather coarsely, not closely punctured except at sides, feebly depressed near front angles, with a median smooth longitudinal line more or less evidently especially posteriorly, without canaliculation, and sparsely clothed with rather coarse, forwardly inclined fulvous pile. Scutellum elongate, rounded at apex, coarsely punctured and setose. *Elytra* as broad as broadest part of prothorax, two and two-thirds as long, with sides quite parallel, the striae well impressed and coarsely punctured, the intervals convex, rugose and with coarse, sparse and inclined pubescence irregularly distributed along them. Beneath rather finely somewhat densely punctured. Legs long and delicate, the second and third tarsal segments of all legs somewhat prolonged beneath and feebly lobed. Length male, 11.0 mm., breadth 3.0 mm.

The female more robust, the antennae shorter and more delicate, the prothorax somewhat broader than long, with disc more convex and the sides more arcurate, and the elytra much more convex and expanded especially behind, giving the afterbody a spatulate appearance.

Holotype male, *allotype* female (Nos. 6199 and 6200, Calif. Acad. Sci., Ent.) and three *paratypes*, two males and one female, all collected by Dr. G. Dallas Hanna, during June, 1949, from the FARALLONE ISLANDS, 25 miles west of the Golden Gate, SAN FRANCISCO, CALIFORNIA. The five specimens were found on the ground and under cover.

This species is related to *Athous excavatus* (Motschulsky) and because of its brown color, looks more like the subspecies *carmeli* Van Dyke (see table, Proc. Calif. Acad. Sci., 20(9):363, and discussion, pp. 373-374, March 3, 1932). In *excavatus*, the pronotal

punctation is somewhat denser, the pubescence finer, longer and gray, the antennae more robust and longer, at least four antennal segments in the males extending beyond the hind prothoracic angles and the tarsal lobes a bit more pronounced. In most of the typical *excavatus* and many of the subspecies *carmeli* the sides of the prothorax are rufous, which is not the case with *farallonicus*.

BUPRESTIDAE

Acmaeodera boharti Van Dyke, new species

Rather small, moderately short and compact, the head and pronotum black or feebly aeneous and finely pilose, the head with white pile, the pronotum with erect black pile, the elytra a deep bluish-black, the under surfaces aeneous, and the insect as a whole somewhat shining and without maculations of any kind. *Head* coarsely, densely punctured, the front longitudinally impressed, transversely impressed at base of clypeus and the latter semicircularly emarginate in front; antennae short, reaching just beyond middle of prothorax, segments 5 to 10 serrate, the eleventh elliptical. *Prothorax* about twice as wide as long, apex feebly biemarginate, base transverse, sides unevenly arcuate and gradually narrowed from base to apex, the disc convex, coarsely, cribrately punctured laterally and rather finely, less densely punctured centrally, with a small feeble impression near center of front margin and a deeper one in front of scutellum, the lateral margin narrow but distinct though concealed when viewed dorsally. *Elytra* at base barely wider than base of prothorax, twice as long as broad, sides feebly sinuate in front of middle but in general gradually narrowed and convergent posteriorly to the rounded apex, the side margin serrate from middle to apex, the disc convex, somewhat flattened medially, the humeral umbone distinct, the striae finely, sharply impressed and finely closely punctured towards the suture, but outwardly very coarsely punctured except for the ninth and tenth striae which are very deeply impressed but less coarsely punctured, the inner intervals flattened and about twice as wide as the striae, becoming narrower and more irregular outwardly as the punctures increase in size, and with the last three more regular, very convex and rugose, each interval in addition with a single row of fine punctures from which arise a row of inclined white setae. Ventral surface shining, coarsely punctured in front and gradually more finely and sparsely punctured posteriorly and sparsely clothed with short, white pile. Prosternum with the front margin sinuate. The last ventral segment without a transverse lobe-like plate before apex. Length 8.0 mm., breadth 3.0 mm.

Holotype (No. 6201, Calif. Acad. Sci., Ent.), a unique collected at Ensenada Honda, Puerto Rico, West Indies, Aug. 20, 1942, by George E. Bohart.

This very distinct species is like no other described species from the West Indies, nor in fact like any from North America.

Chrysobothris sinaloae Van Dyke, new species

Of moderate size, chocolate brown in color and bronzed, somewhat narrow and elongate, and simulating *C. distincta* Laporte and Gory in general appearance. The clypeus broadly shallowly and feebly angulately emarginate with the outer angles of the emargination rounded, the antennae short, with the outer eight segments serrate and gradually narrowed towards the apex. *Prothorax* two-fifths broader than long, apex very feebly bisinuate, the base strongly so with the median lobe prominent, the disc somewhat convex, densely punctured, the punctures well separated centrally but approximate at sides and more or less arranged into transverse rugae, a slight median longitudinal impression generally reaching the apex but well separated from base, and the sides quite parallel in basal two-thirds, rounded in front and obliquely convergent to apex. *Elytra* three times length of prothorax, slightly broader at base than prothorax, humeri prominent, sides quite parallel or feebly sinuate for basal two-thirds, thence gradually narrowed towards apex and rounded to a blunt apex, the lateral margin serrate posteriorly and the disc feebly convex with three well-developed carinae, the sutural one straight and extending forwards two-thirds of the way towards the base, the second sinuate and extending forward from apex to beyond the middle and more or less paralleling the sutural, and the third or outermost, short, feebly arcuate and running from the posterior fovea toward the humeral umbone but generally not reaching it but turning outwardly, the general surface densely punctured especially toward the sides, with a deep fovea to the outer side of the scutellum, a feebly impression between that and the umbone and three well-defined, very densely punctured and somewhat cupreous foveae, the inner one about one-third the distance from the apex and to the outer side of the sutural carina, the second slightly forward of this, to the outer side of the second carina and at the apex of the short third carina, and the third fovea, about a third the distance from the base and straddling the apex of the second carina. The ventral surface bronzed and shining, the tarsi generally greenish, the ventral sclerites rather deeply sulcate medially, somewhat coarsely punctured, the abdomen strigate and clothed with a fine, white pile. In addition each sclerite has an elongate callosity at the side and the margin of the last ventral is finely serrate. The anterior femora have a well-marked tooth, serrate along the outer margin. Length 13 to 16 mm., breadth 5 to 6 mm.

Males with front flattened, densely, finely punctured, bright green, with a dense fine white pile; the antennae green, the front tibiae gradually dilated beneath at the apex, the last ventral segment broadly emarginate, the base of the emargination transverse or feebly sinuous, and the undersurface clothed with white pile, especially evident on the prosternum.

Females with front feebly convex, more coarsely punctured than in the male and rugose, with the pile sparser, both front and an-

tennae bronzed, the front tibiae feebly arcuate and enlarged outwardly but without apical dilation and the last ventral segments with a small notch at the apex.

Holotype male, *allotype* female (Nos. 6202 and 6203 Calif. Acad. Sci., Ent.) and 12 *paratypes*, collected at MORCORITO, SINALOA, MEXICO, Sept. 18, 1947, by Joseph Marquis. Three other specimens collected at Los Mochis, Sinaloa, on Nov. 15, 1947, were also taken by Mr. Marquis.

This species from the west coast of Mexico superficially looks like the larger and more distinctly sculptured *distincta* Laporte and Gory from the interior of Mexico and the smaller and shorter *schaefferi* Obenberger from Lower California, but both these in the male have a very distinct tooth near the apex of the front tibiae whereas in *sinaloae* the front tibiae in the males has only a sudden enlargement near the apex. According to Fisher's table (1942, U. S. Dept. Agric., Misc. Publ. No. 470), it would run close to *peninsularis* Schaeffer from Lower California but it differs from this by being larger, with a much broader prothorax, the males with a green forehead and the front tibiae with the apical enlargement a simple dilatation with at most a small tooth inwards whereas in *peninsularis* the forehead is bronzed and the front tibiae with a prominent tooth at the base of the enlargement.

CURCULIONIDAE

Eupagoderes bryanti Van Dyke, new species

Rather small, short and compact; clothed above with light brown and white scales irregularly distributed and closely applied in a tesselated manner; the head, a broad band at sides of prothorax and the underside with white scales, in close contact on the head and feebly imbricated at sides of prothorax and beneath; a band of brown scales on either side of the middle of pronotum and the hind femora barred. *Head* convex, a well-marked transverse impression separating it from the rostrum, the latter distinctly trisulcate, the median sulcus ending at the transverse impression and the lateral short but linear. *Prothorax* one-sixth broader than long, the sides arcuate, narrowing in front, almost parallel in posterior two-thirds, the disc with a few coarse punctures and numerous small ones but these latter are in most cases concealed by the dense scaly vestiture. *Elytra* cordiform, but little broader at base than base of prothorax, and almost a third longer than broad; disc evenly convex, the striae finely impressed and finely regularly punctured, the intervals feebly elevated centrally and with a row of minute punctures down their center from which arise very short curved setae. Legs robust, apices of hind tibiae obliquely truncate, the third tarsal segment enlarged and lobed. Length 8.5 mm., breadth 4.0 mm.

Holotype (No. 6204, Calif. Acad. Sci., Ent.) and 16 *paratypes*, collected in the BABOQUIVARI MOUNTAINS, ARIZONA, Sept. 23, 1933, by Owen Bryant.

This species along with *halli* Van Dyke and *huachucae* Van Dyke forms a small group of related species characterized by being of medium size, compact, with the rostrum trisulcate, the median sulcus not extending above the transverse impression, a maculate design, and the upper surface densely clothed with scales arranged in a definite tesselated or pavement manner. In *halli* the anterior tibiae are not serrate beneath, the head is flattened or but feebly convex with the result that the rostrum is not distinctly limited above by a transverse impression, the elytral striae sharply defined and the scales either black or white giving the beetle a gray appearance. Since the original description of *halli* based on five specimens was published, we have received 23 additional specimens all more or less uniform as to color and general appearance. In *bryanti*, a species of the same size and shape as the above, the anterior tibiae are serrate beneath, the scales are brown and white, the head feebly convex thus definitely limiting the rostrum above, and the elytral striae vaguely indicated, defined more by the row of strial punctures than the impressed striae. The pronotum is also so densely clothed with scales, more or less imbricated, that the coarse punctures are concealed which is not the case in either *halli* or *huachucae* where the scales are tesselated and numerous large punctures are exposed. Placed side by side the black and white scales of *halli* strongly contrast with the brown and white scales of *bryanti*.

Tosastes columbianus Van Dyke, new species

Black, densely clothed with imbricated scales, gray beneath, and gray above maculated with dark brown as follows: a broad band, narrowed on occiput, extending down the middle of the head and rostrum, another down the middle of pronotum, sometimes expanded so as to cover the entire disc, and irregular patches, often ocellate scattered over the elytra. *Head* slightly convex, separated from the rostrum by a feeble transverse impression, the rostrum broad, a bit longer than wide, somewhat flattened above in basal area and with the apex well arched; eyes of moderate size and quite flattened. *Prothorax* about one-third broader than long, sides feebly arcuate at middle, obliquely narrowed in front and quite straight and parallel behind, the disc coarsely, densely punctured and generally with a faint median longitudinal groove. *Elytra* oval, a bit broader at base than base of prothorax, broadest at middle, the disc convex, the striae well impressed and quite coarsely, regularly punctured, the

intervals convex and ornamented with an irregular double row of short, hooked setae. Legs stout, the hind tibiae subtruncate and with a double row of spines. Length 4.5 mm., breadth 3 mm.

Holotype (No. 6205, Calif. Acad. Sci., Ent.) and four *paratypes* collected at KAMLOOPS, BRITISH COLUMBIA, May 1, 1932, by Owen Bryant.

This small species structurally belongs near *Tosastes cinarescens* Pierce and superficially resembles some of the smaller, more irregularly maculate specimens. It differs, however, by having a narrower prothorax which is also more deeply and closely punctured, a head which is definitely convex, not flattened, a rostrum which is quite convex and depressed apically and with eyes which are more flattened.

Crocidema arizonica Van Dyke, new species

Elongate, dark brown, densely clothed with brownish or opalescent scales and with rather stiff hairs varying in degree from sparse to rather dense. *Head* as long as prothorax, the front moderately convex, with a well marked transverse impression between it and the arcuate beak, sparsely punctured, the punctures mostly concealed by the scales, and with semierect stiff pile, the rostrum narrower than interocular area in male, about as broad in female, quadrate; eyes large but quite flattened, projecting but little beyond side of head, the scrobes deep, not reaching eyes but curved beneath in front of eyes. *Prothorax* slightly broader than long in the male and considerably broader in the female, front margin feebly arcuate, transverse base, the sides arcuate, the disc rather densely punctured though the punctures are concealed by the scales and the post-ocular lobes are evident but not prominent. *Elytra* two and two-thirds times length of prothorax, elongate elliptical in the male, broader and slightly cordate in female, disc somewhat flattened, declivity rounded, the striae well impressed especially at sides and rather deeply punctured with rounded closely placed punctures, the intervals flat, very finely punctured and with the stiff pile irregularly distributed. The underside finely punctured and sparsely pubescent. Length male holotype 10.0 mm., breadth 3.5 mm., female allotype, length 11.0 mm., breadth 4.0 mm.

Holotype male, *allotype* female (Nos. 6206 and 6207, Calif. Acad. Sci., Ent.) and six designated *paratypes* collected by Owen Bryant in the SANTA CATALINA MOUNTAINS, ARIZONA, the first July 15, 1938 (Lot 21), the second June 20, 1933, the others on July 15, 1938. I have associated with these various specimens from the Chiricahua Mountains and Santa Rita Mountains of Arizona, also one specimen from the Chisos Mountains of West Texas.

This species is rather closely related to *attenuata* Van Dyke (Pan-

Pacific Ent., 10(4):186-187, 1934) but differs by being generally larger and more robust, the scales more opalescent, the eyes less prominent, flatter, the funicular segments of antennae very similar in breadth whereas gradually wider apically in *attenuata* and the elytral striae generally deeper and the punctures coarser.

Peritaxia longipennis Van Dyke, new species

Rather large for the genus, narrow, elongate, black, antennae and tarsi rufopiceous, densely clothed with very closely applied scales which appear of the general body color though they are somewhat opalescent under good light and high magnification, and are arranged in a tesselated manner, and sparsely pilose, the pile semierect and denser on head and elytral declivity. *Head* one-third longer than prothorax, convex above, feebly flattened in front, finely punctured behind, coarsely punctured in front, distinctly separated from rostrum by a rather deep transverse impression; the rostrum broad, feebly arcuate, coarsely, densely punctured, wider in front and triangulately emarginate apically; the antennae with scape long and clavate, the funicle with the first and second segments twice as long as broad, segments 3 to 7 slightly longer than broad, the terminal segment long and fusiform, almost equal in length to the three preceding segments; the eyes feebly convex and moderately prominent. *Prothorax* two and one-half times as broad as long, base and apex transverse, sides evenly and moderately arcuate, disc feebly convex, finely granular in appearance as a result of the scales, with a well-impressed narrow line medially, and a moderate number of coarse, well-spaced punctures but coarsely punctured and rugose laterally. *Elytra* two and a half times as long as prothorax and about one-fifth longer than broad; base feebly emarginate, basal angles right angled though feeble, disc convex, the declivity abrupt, almost perpendicular, the striae well defined by the coarse, closely placed punctures, the intervals almost twice as wide as striae and feebly convex. Ventral surface rather finely, densely punctured and sparsely pubescent. Length 9.0 mm., width 4.0 mm.

Holotype (No. 6208, Calif. Acad. Sci., Ent.) and one *paratype* collected in Oak Creek Canyon (south of Flagstaff), Arizona, July 25, 1936, by Owen Bryant.

This species when compared with larger specimens of *rugicollis* Horn appears generally narrower and more elongate, the pronotum less markedly rugose, the elytra much longer and elliptical with humeri angles small, not somewhat cordate and pronounced, and the strial punctures more numerous and rounded. Other described species are generally smaller, proportionally shorter, with the pronotum more rugose, the elytra more cordate in shape and with prominent humeral angles.

Onychobaris langei Van Dyke, new species

Elongate oval, convex, subopaque, the general surface alutaceous, black, the legs piceous or sometimes feebly rufous, setae very minute and inconspicuous. *Head* sparsely, finely punctured, sometimes with a small fovea at base of rostrum, the rostrum about 1.5 mm. long, evenly arcuate, of moderate robustness, rather coarsely punctured towards base and finely towards apex. *Prothorax* robust, slightly broader than long, with sides evenly arcuate, the apex constricted, the base broadly bisinuate, the median lobe wide and prominent, the disc rather coarsely, densely punctured, the punctures contiguous laterally, and with a well marked median smooth line. Scutellum transverse and feebly impressed at center. *Elytra* almost a third longer than broad with rather prominent humeri which make the elytra wider there than the base of the prothorax, with sides feebly convergent posteriorly, well-rounded at apex, the disc with coarse, deep and abrupt striae, the intervals flat, equal, distinctly wider than striae, each with a single series of well-impressed rounded, contiguous punctures. Beneath coarsely, closely punctured laterally, more finely and sparsely at center of abdomen. Length 5.0 mm. excluding beak, breadth 2.5 mm.

Holotype (No. 6209, Calif. Acad Sci., Ent.) and seven *paratypes* collected by Dr. W. H. Lange at El Segundo, Los Angeles Co., California, September 28, 1938. They were found on *Oenothera spiralis*, close to the roots. Four specimens were returned to Dr. Lange.

The species, according to Colonel Casey's key (Col. Notices IV, 1892, pp. 522-524), runs close to *molesta* Casey from Arizona, but aside from locality, differs by having dense approximate pronotal punctures, confluent at sides, a very much more distinct median smooth line on disc, a less robust rostrum, a subopaque or duller appearance, and piceous instead of red legs.

DEROBRACHUS GEMINATUS ON GRAPE ROOTS

(Coleoptera: Cerambycidae)

Larvae of *Derobrachus geminatus* Leconte were found feeding on grape root stock near Indio, California, August 30, 1950, by Mr. B. Laflin. The land had been cleared for about one year. Formerly it had been covered by mesquite (*Prosopis glandulosa* Ckll.), a natural host of the beetle. Mr. Laflin tells me he has found four other such cases. I am indebted to Dr. E. C. Van Dyke for identifying the specimens.—Sherman L. Thomas, Indio, California.

OFFICIAL SEAL CONTEST

It has long been felt that the Pacific Coast Entomological Society should have some significant identifying seal which could be affixed to official Society documents, stationery and publications. To stimulate interest in the choice of this official seal, it has been decided to conduct a contest for the purpose of selecting the best and most appropriate design to be submitted by a reader of the Pan-Pacific Entomologist. The person who creates the chosen seal will receive a complete up-to-date set of the Pan-Pacific Entomologist.

Contest entries should be drawn in large size on heavy white paper (8½ x 11). All drawings must be carefully inked. It is considered advisable to include the title "Pacific Coast Entomological Society" as an integral part of the official seal, so be sure to include this printing on the submitted design. The name and address of the contestant must appear on the *reverse* side of each contest entry. Mail the completed drawings to Dr. J. Gordon Edwards, Department of Natural Sciences, San Jose State College, California, postmarked on or before April 1, 1951.

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After a preliminary screening, the surviving entries will be examined by a board of entomologists who will choose a number of the most appealing entries for further consideration. The remaining drawings will then be photographed and a lantern slide of each will be projected for viewing by the members present at the May meeting of the Pacific Coast Entomological Society. The final winning seal will be chosen by popular vote at that time—J. Gordon Edwards.

— EDITORIAL NOTES —

The editors wish to draw to the attention of contributors to the *Pan-Pacific Entomologist* an article "Notes on writing sentences," by J. Ansel Anderson, which appeared in the *80th Annual Report of the Entomological Society of Ontario*, pages 7 - 10. 1949 [1950].

E. C. VAN DYKE HONORED

Dr. Edwin C. Van Dyke has been notified of his election by popular ballot to the presidency of the Coleopterists' Society. Dr. Van Dyke, who will be 82 on April 7, is Emeritus Curator of Entomology at the California Academy of Sciences, where he donates his time six days a week. He is currently finishing a monograph on the Coleoptera of the Galapagos Islands.

THE ENTOMOLOGICAL SOCIETY OF CANADA

At the eighty-seventh annual meeting of the Entomological Society of Ontario, held at Guelph on November 1 - 3, 1950, it was decided to form a national society, to be called the Entomological Society of Canada. The new society will serve as a link between the various regional societies, namely, the Acadian Entomological Society, the Entomological Society of Ontario, the Entomological Society of Manitoba, the Entomological Society of British Columbia, the proposed entomological society of Quebec, and others that may be established. *The Canadian Entomologist* will be published jointly by the Ontario and the national societies, Dr. W. R. Thompson continuing as Editor, with Dr. G. C. Ullyett as Associate Editor.

PACIFIC COAST ENTOMOLOGICAL SOCIETY

E. O. ESSIG
Vice-President

R. L. USINGER
President

D. D. JENSEN
Secretary

PROCEEDINGS

Two Hundred and Ninth Meeting

The two hundred and ninth meeting of the Pacific Coast Entomological Society was held at 2:00 p.m. on January 28, 1950, in the entomological laboratories of the California Academy of Sciences, San Francisco. President Ferris conducted the meeting. The following members were present: R. F. Fritz, E. G. Meyers, J. P. Harville, J. W. Tilden, E. O. Essig, A. E. Michelbacher, E. G. Wegenek, E. C. Van Dyke, H. B. Leech, S. L. Thomas, V. Stombler, A. Retan, P. H. Arnaud, Jr., C. P. Hoyt, F. X. Williams, J. W. Green, B. Brookman, B. D. Culver, D. C. Thurman, Jr., E. B. Thurman, J. E. Gillaspy, D. P. Furman, W. W. Middlekauff, L. W. Quate, D. Gould, R. L. Usinger, P. D. Hurd, Jr., W. Barr, E. G. Linsley, W. D. Murray, T. Aarons, L. P. Coy, O. W. Graf, Jr., W. Hoyt, E. L. Kessel, C. W. Hildebrand, R. C. Miller, R. M. Bohart, R. Potts, D. D. Jensen, and W. H. Lange. The following visitors were present: Doris R. Thomas, Harold W. Brydon, Howard H. Abram, J. M. Savage, R. R. Harry, J. N. Simons, Harry Freeman, Heidi Aarons, J. E. Ryus, Mrs. R. M. Bohart, J. Bohlke, G. S. Myers, P. S. Lange, and J. W. Skousen.

The minutes of the meeting held December 3, 1949, were read and approved.

The membership committee proposed and the Society elected C. A. Downing and Harold A. Brydon as members.

The President then called for notes, exhibits and remarks. Dr. Ross reported that the Academy is considering a Hall of Insects for public display, and discussed briefly the type of exhibits being proposed.

Dr. Ross exhibited specimens of a rare arthropod class, the Pentastomida. These had been taken from the liver of an African rock python, collected by Borys Malkin in the British Cameroons, May 28, 1949. The cork-screw form of the body shows no obvious relationship to the other arthropods even though it is considered to be related to the mites. Dr. Ross also exhibited a box of 108 microscope slides each bearing the male and female of a separate species of flea. This is one of 20 such exhibit sets of fleas prepared by C. A. Hubbard to be used with his book on fleas.The first set was deposited in the U. S. National Museum and the second is in the California Academy of Sciences.

Mr. H. B. Leech circulated a publication on the Siphonaptera of Canada by George P. Holland.

Dr. Richard Bohart exhibited two species of Strepsiptera, one of which is parasitic on the Thysanura and the other on the Pentatomidae. The latter has been used in biological control efforts against a bug which is a pest of coffee in Africa.

Mr. Aarons reported that preliminary plans are being drawn up for a study of the flight range of the mosquito *Aedes squamiger* (Coq.) in the San Francisco Bay area. The mosquitoes, emerging from 20 acres of the Petaluma Creek basin area, will be marked and attempts will be made to recover them at various locations in the bay region. The details of the experiment have not been decided upon but marking will probably be accomplished by using a fluorescent dye.

President Ferris introduced as the main speaker of the meeting, Dr. Robert L. Usinger, Associate Professor of Entomology, University of California, Berkeley, who spoke on the subject: "The Paris Meetings of the International Commission on Zoological Nomenclature."

The situation as regards international nomenclature before the Paris Meetings was briefly outlined and was followed by an account of the actual meetings held in Paris.

Important decisions such as liberalizing the procedure of the Commission, defining the term "binary," providing for infra-subspecific categories and clarifying the subject of homonyms were discussed in some detail.

Finally, the events subsequent to the Paris meetings were outlined, including publication of the proceedings.

Dr. Usinger's report stimulated considerable discussion and questions among the members present before the meeting was adjourned at 4:30 p.m.—D. D. JENSEN, *Secretary*.

Two Hundred and Tenth Meeting

The two hundred and tenth meeting of the Pacific Coast Entomological Society was held at 2:00 p.m. on February 25, 1950, in the entomological laboratories of the California Academy of Sciences, San Francisco. President Ferris in the chair. The following members were present: G. F. Ferris, D. D. Jensen, W. W. Middlekauff, A. E. Pritchard, H. H. Abram, R. L. Usinger, B. Brookman, C. D. Grant, O. W. Graf, Jr., J. W. Tilden, W. C. Day, J. N. Simons, W. H. Nutting, T. W. Cook, V. Stombler, C. H. Spitzer,Jr., K. Innes, B. B.

Kessel, E. L. Kessel, P. H. Arnaud, Jr., C. A. Downing, E. S. Ross, J. W. Green, W. Barr, C. Don MacNeill, H. A. Scullen, M. Marquis, S. L. Thomas, E. C. Van Dyke, E. G. Wegenek, A. E. Michelbacher, E. O. Essig, J. W. MacSwain, H. B. Leech, H. H. Blakemore, F. X. Williams. Visitors were present as follows: Rex Bartges, L. P. Coy, Marian Kendall, Sylvia Spitzer, Don Kelley, W. C. Bentinck, F. L. Rogers, Joy Hogan, Lucy Jones, Allen Bartel, Enid Moor, Doris R. Thomas, Gretchen Baumgartner, Lois MacDonal, Metta Weddleton, Linda Sorensen, Franklin Devore, John Schmiedel, Sally Barrett, Christine Owens and Borys Malkin.

The minutes of the meeting held January 28, 1950, were read and approved.

The membership committee proposed and the Society elected the following as members: J. H. Freitag, F. C. Hottes, B. J. Spencer, Ernest R. Tinkham, and Howard Abram.

The President appointed a committee, composed of Dr. Tilden and Dr. Ross, to determine the location for the annual field meeting and report at the next meeting.

The President called for notes, observations and exhibits. Dr. Ross called attention to a display of some of the 250,000 insects collected by Mr. Malkin in Africa.

Dr. Usinger displayed the superb illustrations made by Arthur Smith of the British Museum of 50 new genera of Aradidae. In the past only 50 genera were known in this family. The large number of new genera were found by Dr. Usinger because it was previously not recognized that adult aradids could be wingless. Heretofore such specimens were considered to be nymphs.

The President then introduced as the main speaker of the meeting, Mr. Borys Malkin, Research Associate of the California Academy of Sciences, who spoke on "Entomological Observations in Africa." A summary of Mr. Malkin's discussion is given below.

Mr. Malkin spoke of his experiences during a 16 month trip in Africa, from August, 1948, until December, 1949. The first three months were devoted to collecting in North Africa starting off from Tripoli through Tunisia and into Algeria. Desert conditions prevailed throughout most of this territory except for a relatively narrow strip around Algiers. A bus trip southward through the Sahara desert, French Sudan and Dahomey into Nigeria marked the second stage of the journey. Mr. Malkin remained in Nigeria and the British Cameroons nearly 7 months and covered a considerable portion of the colonies. Here the work extended from the peak of the dry season to the peak of the rainy season during which time considerable change occurred in the composition of the insect fauna. Collecting on the whole was strenuous and not too rich except for aquatic Coleoptera and Hemiptera of which nearly 15,000 specimens were

taken. Concentration of species even in a small body of water was enormous and a count, from a tiny pond in Ogbomosho, Southern Nigeria, showed over 100 species of aquatic Coleoptera. The rain forest was limited to the southernmost part of the colony and even here it had been practically eliminated by intense cultivation. However, great stretches of such forests still survive in the Benin province in the Niger Delta and are practically untouched in the Southern Cameroons.

Over a month was devoted to working up the various vegetation zones of Mt. Cameroon which practically rises from the sea, with mangrove swamps at the bottom and the rain forest belt at about 2,500 feet. Next comes mid-mountain forest up to 4,500 feet. It is this zone which he found richest in insect life. One of the characteristic forms was a staphylinid *Osorius* later also found on São Tomé Island in the Guinee Gulf and in the Knysna Forest in South Africa. Above 4,500 feet, ringed by tree ferns, occurs the mist forest which extends to 7,500 feet in places. In this zone the fauna is distinctly impoverished. Above the forest are grasslands to 10,000 feet where the last trees disappear with mosses and lichens taking over to the peak. At 10,000 feet very few insects occur, the most characteristic form being sawflies.

In June, 1949, Mr. Malkin moved into the French Cameroons, working over into the grassy highlands, and in July to the Portuguese Island of São Tomé where an endemic and presumably new species of *Licinius* was collected in the mountains. During August and September Angola was explored. The Northern Highlands of this colony show close relationship to the Cameroons and Nigeria whereas the arid coastal strip and the sandy eastern part of the colony resemble the Kalahari sands. Hardly any duplication occurred in species and such groups as the chrysomelids, buprestids, meloids and cincindelids occurred in particular abundance.

The last six weeks of the expedition were devoted to the exploration of the Eastern Cape province and parts of Namaqualand, the latter trip undertaken jointly with Dr. Karl Koch, an entomologist of the Transvaal Museum in Pretoria. Work in the mountains back of Capetown revealed an entirely different fauna, such groups as melyrids, malachiids and clerids being especially numerous. The virgin forest of Knysna, a coastal strip along the southern shores, reminded Mr. Malkin very much of the western Oregon forests. Trips up Table Mountain, especially to Blinkwater Falls, yielded several new genera and species of hydrophilids, some of which show affinities to the Chilean fauna.

In addition to his comments on entomological exploration Mr. Malkin discussed particularly the local mode of travel and living conditions in the various areas visited.

After a discussion of Mr. Malkin's talk, the meeting was adjourned.—D. D. JENSEN, *Secretary*.

Two Hundred and Eleventh Meeting

The two hundred and eleventh meeting of the Pacific Coast Entomological Society was held at 2:00 p.m. on April 1, 1950, in the entomological laboratories of the California Academy of Sciences, San Francisco. President Ferris conducted the meeting. The following members were present: G. F. Ferris, D. D. Jensen, R. L. Usinger, J. W. MacSwain, E. R. Leach, E. O. Essig, F. X. Willams, B. D. Culver, D. P. Furman, B. Brookman, W. W. Sampson, H. B. Leech, E. C. Van Dyke, H. W. Brydon, C. A. Downing, C. W. Hildebrand, K. F. Innes, Jr., J. W. Tilden, J. R. Walker, G. F. Augustson, R. C. Miller, E. S. Ross, P. A. Adams, A. E. Pritchard, E. G. Wegenek, W. C. Bentinck, A. E. Michelbacher, T. W. Cook, and E. L. Kessel. The following visitors attended: Mrs. G. F. Augustson, Ruth Vickery, H. E. Stark, W. H. Renner, L. P. Coy and F. M. Prince.

The minutes of the previous meeting were read and approved.

The membership committee proposed and the Society elected William C. Bentinck as a member.

Dr. Ross, Chairman of the field meeting committee, reported that Portola State Park in San Mateo County had been selected as the site for the annual field meeting which will be held May 7, 1950.

In response to the President's call for notes, exhibits and remarks, Mr. H. Leech reported that Mrs. Fred Winters of Santa Barbara had made a gift to the Academy of the collection of water beetles, particularly Hydrophilidae, made by her late husband.

Dr. Ross reported that Dr. L. Hewes, an amateur lepidopterist, of San Francisco, died recently and had willed his collection of butterflies to the Academy.

Professor Ferris called attention to the recent death of Dr. P. N. Annand, Chief of the U. S. Bureau of Entomology and Plant Quarantine and former member of the Society.

Dr. MacSwain reported that the University of California field course in entomology will be held this summer in the San Gabriel Mountains and invited members of the Society to visit the camp.

Dr. Kessel raised the question of having some meetings of the Society in the evening instead of Saturday afternoon. After some discussion a motion was made and carried that the Program Committee schedule at least one evening meeting during the fall season.

President Ferris then introduced F. M. Prince, Medical Entomologist of the Western Communicable Disease Center Laboratory, San Francisco, who addressed the Society on the subject: "Objectives and Methods in Studies of Plague Transmission." Mr. Prince's remarks are summarized below.

Plague first appeared among humans and rats in San Francisco in 1900 and was discovered among California ground squirrels in

1908. Since 1934, the Public Health Service has extended the search for plague in wild and domestic rodents and their ectoparasites to 17 Western States. Plague has been found in 137 counties in 15 States. The infection was demonstrated most frequently in ground squirrels, marmots, prairie dogs, and wood rats.

Transmission studies were conducted with different species of wild and domestic rodent fleas using white mice as the test animal for the studies. A series of slides in color demonstrating techniques in conducting the studies were shown. Color microphotographs illustrating the evolution of plague masses in a wild rodent flea *(Monopsyllus wagneri)*, and a domestic rat flea (*Xenopsylla cheopis)* were also presented. The development of mass formations in wild rodent fleas is usually quite different from that of *X. cheopis*. Masses usually originate in the stomach of wild rodent fleas and take several weeks or months to produce complete blockage of the stomach, whereas, the masses originate in the proventriculus of *X. cheopis* and produce complete blockage in a much shorter period. Under laboratory conditions *X. cheopis* proved to be the most efficient vector of plague tested.

Following a discussion of Mr. Prince's talk, the meeting was adjourned.—D. D. JENSEN, *Secretary*.

Two Hundred and Twelfth Meeting

Portola State Park, May 7, 1950

The two hundred and twelfth meeting of the Pacific Coast Entomological Society was held as the annual field meeting at Portola State Park, San Mateo County, May 7, 1950.

The recorded attendance was 59 persons, including 14 members, 20 adult visitors and 25 children. The following members were present: Howard Abram, P. H. Arnaud, E. S. Ross, E. C. Van Dyke, F. X. Williams, W. H. Lange, H. B. Leech, J. W. Tilden, O. W. Graf, M. Marquis, J. H. Freitag, D. D. Jensen, A. E. Pritchard, and A. E. Michelbacher. Visitors were present as follows: Mrs. Howard Abram, Marguerite Arnaud, K. G. Swenson, Vaudis Swenson, Winona C. Farr, Mr. and Mrs. Ernest Schneider and family, Pauline Lange and family, Dr. and Mrs. Steve Dorman and family, Hazel Tilden and son, Anne Minaker, Mrs. M. Marquis, Steven D. Marquis, Elinor B. Freitag, Mr. and Mrs. J. L. Brady, Dr. and Mrs. E. S. Sylvester and family, Dr. and Mrs. Eugene Stafford and family, Mrs. A. E. Michelbacher.

The weather was good and although some collecting was done most of the time was spent in visiting.—D. D. JENSEN, *Secretary*.

Two Hundred and Thirteenth Meeting

The two hundred and thirteenth meeting of the Pacific Coast Entomological Society was held at 8:00 p.m. on October 13, 1950, in the entomological laboratories of the California Academy of Sciences, San Francisco. President Ferris conducted the meeting. The following members were present: Berta B. Kessel, E. L. Kessel, A. E. Michelbacher, E. O. Essig, M. Marquis, W. C. Day, G. F. Ferris, R. L. Usinger, E. C. Van Dyke, S. B. Freeborn, W. W. Middlekauff, J. W. Tilden, P. A. Harvey, W. Hazeltine, P. D. Hurd, Jr., F. X. Williams, J. E. Gillaspy, J. G. Edwards, P. H. Arnaud, L. M. Henry, C. D. Duncan, H. B. Leech, L. W. Quate, J. W. MacSwain, L. P. Coy, W. C. Bentinck, S. G. Watkins, C. A. Downing, E. S. Ross, D. D. Jensen, and G. A. Marsh. Visitors were present as follows: Bernard Adelson, Robert Schuster, Harold Stark, Harry L. Hansen, S. C. Daniels, Lynne Scott, Neva Duncan, W. F. Ehrhardt, Mrs. J. W. MacSwain, Norman Lewis, and G. F. Edmunds.

The minutes of the meeting held April 1 and of the field meeting held May 7, 1950, were read and approved.

The membership committee proposed and the Society elected the following as members: Mrs. Ruth C. Whitney, Robert Snelling, and Gordon Marsh.

President Ferris appointed H. B. Leech, Paul Arnaud and J. W. MacSwain as a committee to propose a slate of officers at the annual meeting in December.

Dr. Hurd, chairman of the committee appointed to review the constitution, distributed mimeographed sheets carrying proposed modifications in the by-laws of the Society which will be acted upon at a later meeting.

President Ferris asked for an expression of opinion from the members present regarding the time of day meetings should be held. After some discussion a motion was made and carried that the meeting time alternate between afternoon and evening.

In response to the President's call for notes and exhibits Dr. Duncan displayed a species of syrphid fly which has been very abundant at San Jose for the past six weeks. The species, *Tubifera aenea* (Scopoli), was found clustered in large numbers in paper bundles, wrappings and other secluded places. Dr. MacSwain reported that this species commonly infests solitary wasp cells, and cracks, and suggested that the flies might be getting ready for hibernation.

Dr. Duncan also reported that the owner of a new home in San Jose had become alarmed because a bostrychid, *Stephanopachys pacificus* Casey, infested the lumber of the house. Both larvae and adults were found. Although mainly in the sapwood under the bark, specimens were also found deep in the wood. Dr. Van Dyke expressed the opinion that the species would not breed very long in finished lumber.

Dr. Duncan reported an infestation of dry wood termites in a piece of solid wood. The reproductive alates were found.

Dr. Edwards reported finding a female of *Poreospasta polita* Horn mating with a male of *Lytta auriculata* Horn, and commented that this observation is additional evidence that the two species are closely related, as indicated by Dr. MacSwain's larval studies.

Professor Ferris called attention to a fine collection of bedbugs which he had brought with him and which were available for examination.

President Ferris introduced as the main speaker of the meeting, Mr. George F. Edmunds, Jr., of the University of Utah, who spoke on the subject: "Notes on the mechanics of flight and wing venation of the Ephemeroptera and their ancestors, with remarks on the archetype wing venation of the insects." The talk was based on studies conducted jointly by Mr. Edmunds and Jay R. Traver of the University of Massachusetts. A summary of the talk, which was illustrated by lantern slides and a cardboard model of an insect wing, is summarized below.

The typical forewing of a mayfly is triangular in shape, and fan-like in appearance due to corrugations, or fluting, resulting from a complete alternation of concave and convex veins near the margin of the wing. The corrugations strengthen the wing and make it more rigid. The convex veins brace the wing on the downstroke and the concave veins brace it on the upstroke. The wing is further strengthened by the close grouping of the costa, subcosta and radius 1 which are held firmly together by a costal brace.

Although the mayfly wing appears to be wholly rigid, some of the main longitudinal veins have obvious weakened spots or bullae midway of their length. These bullae allow the concave veins to bend sharply and consequently fail to support the distal half of the wing on the upstroke. From these facts it can be seen that the corrugations or fluting of the wing, and the bullae serve important flight functions. On the downstroke, the wing remains rigid and the insect gets a maximum amount of lift and propulsion. The failure of the bullae equipped veins to support the wing tip, however, allows the distal half of the wing to bend downward on the upstroke as a result of the pressure of the opposing air. Thus the air slips away in such a manner as to offer lessened resistance to the wing.

When examined in cross section it is seen that in general the convex veins belong to the upper wing surface and the concave veins to the lower wing surface. All veins and cross veins appear to be arranged in such a way as to brace the wing.

The mayfly wing is apparently an excellent lift type wing but it is not adapted for speed. In those insects that fly rapidly the anterior margin of the wing is rigid, and the remainder of the wing membrane is flexible. These insects fly by means of a sculling action in which the rigid anterior margin leads the membrane in the direction of the wing stroke. Experiments and observations on the Ephemeroptera indicate that the fluted wing seriously interferes

with sculling action. But in some Ephemeroptera such as *Lachlania* the fluting of the wing has been interrupted by the loss of many intercalary veins and these mayflies appear to be the strongest fliers in the order. They clearly demonstrate the superiority of the sculling type over the fluted wing.

At the present time there seems to be no adequate explanation of the origin of fluting in insect wings, but the speaker's study of the mechanics of mayfly flight have led him to believe that fluting of the wing was an adaptation which added rigidity to the wing as it thinned out into an effective flight surface. The most ancient winged insects are found in the Upper Carboniferous, but it is evident from the great variety of wing types in these fossils that the first winged insects are of greater antiquity. Entomologists have thus had to hypothesize as to the nature of the wings of the first pterygote insects. The present concept of this archetype venation is illustrated by Snodgrass (Fig. 121A) in his *Principles of Insect Morphology*. The veins in this archetype are considered to be either concave or convex in position but there is no complete or functional fluting.

We, therefore, offer the hypothesis that the archetype wing was a completely fluted wing with intercalary veins, not too unlike that of *Lithoneura mirifica* Carpenter, an Upper Carboniferous paleodictyopteran believed to be very close to, if not on, the ancestral line of the mayflies. The fossil record clearly shows that the so-called intercalary veins are true veins and that their free basal ends are a secondary condition.

Several facts seem to support the idea that the wings of the first pterygote insects were completely fluted. In all the winged orders the veins show evidence of being concave or convex and the veins often appear to belong to one surface or the other in cases where the concave or convex positions are obscure. As this seems to be of no functional value in most orders, we would consider these to be vestiges of once functional structures. The fact that fluting is more common in Upper Carboniferous forms than in recent forms would seem to be an additional evidence. The concept of an archetype wing with complete fluting also indicates an adaptational significance to the evolutionary trends of fluting in insect venation.

Even though fluting appears to have been necessary for the thinning out of the wings into effective flight surfaces, it would be a detriment to the development of the rapid sculling type of flight. The trend in the evolution of insect wings seems to be from the fluted type toward the speed type wing with a rigid anterior margin and a comparatively flexible membrane.

In light of the hypothesis that the completely fluted wing is more primitive than that generally conceded to be the archetype venation, the origin and major phylogenetic lines of ephemerid evolution were discussed in some detail.

After considerable discussion the meeting was adjourned.—D. D. JENSEN, *Secretary*.

Two Hundred and Fourteenth Meeting

The two hundred and fourteenth meeting of the Pacific Coast Entomological Society was held at 2:00 p.m. on December 9, 1950, in the entomological laboratories of the California Academy of Sciences, San Francisco. President Ferris conducted the meeting. The following members were present: J. H. Freitag, C. D. MacNeill, P. A. Adams, Gene Morris, E. C. Van Dyke, R. L. Usinger, E. O. Essig, W. C. Day, J. W. MacSwain, F. X. Williams, Wm. Hazeltine, R. L. Doutt, E. G. Linsley, H. W. Brydon, C. P. Hoyt, C. L. Scott, P. H. Arnaud, K. F. Innes, E. L. Kessel, W. D. Murray, R. C. Miller, H. B. Leech, S. G. Watkins, J. G. Edwards, L. M. Henry, J. W. Tilden, G. A. Marsh, J. P. Harville, E. A. Smith, W. C. Bentinck, R. Snelling, J. J. De Bois, G. F. Ferris, B. E. White, A. E. Pritchard, L. R. Gillogly, D. J. Gould, P. D. Hurd, Jr., L. W. Quate, J. W. Green, O. W. Graf, Jr., and D. D. Jensen. The following visitors were present: E. S. Sylvester, Phyllis Morris, Allan D. Telford, J. F. Reinhardt, F. H. Lauret, Y. Tanada, H. R. MacCarty, Mrs. Burdette White, T. F. Stubbs, Norman Lewis, A. A. Hubert, Barbara Prendergast, and Benjamin Keh.

The minutes of the meeting held October 13, 1950, were read and approved. The membership committee proposed and the Society elected the following new members: W. H. Wade, Elbert B. Dixon, P. D. Gerhardt, Alexander A. Hubert, and Charles L. Scott. Professor Essig read a report of the historical committee outlining recommendations for the commemoration of the fiftieth anniversary of the Society in 1951. Dr. Miller presented a financial report of the Society up to November 30, 1950. Mr. Day reported that the auditing committee had examined the financial records of the Society and found them in good order.

The President then called for notes, exhibits and remarks. Mr. Arnaud exhibited a collection of males of an undescribed species of braconid in the genus *Blacus* which he had observed swarming on a number of occasions, usually in the early evening, both in the spring of 1948 and 1949 at Redwood City.

Mr. Leech, representing the nominating committee, proposed and the Society elected the following officers for 1951: R. L. Usinger, President; E. O. Essig, Vice-President; D. D. Jensen, Secretary; R. C. Miller, Treasurer; and E. L. Kessel and G. F. Ferris, Executive Board Members at Large.

Dr. Edwin C. Van Dyke, only living charter member, was elected Honorary President of the Society for the semicentennial year 1951.

The chairmanship of the meeting was then turned over to the president-elect, Dr. Usinger, who called on Professor Ferris to give his retiring presidential address entitled "Entomology, Aesthetics and Science." Professor Ferris' address created considerable interesting discussion before the meeting was adjourned.—D. D. JENSEN, *Secretary.*